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REPORT

ON THE SURVEYS

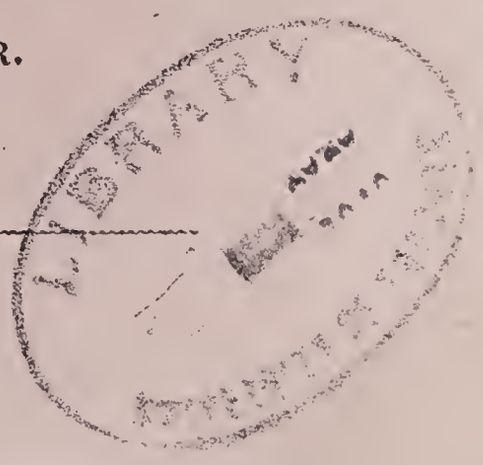
OF THE

QUEBEC AND RICHMOND

RAILWAY.

BY A. C. MORTON, Esq.,

CIVIL ENGINEER.



QUEBEC:

PRINTED AT THE MORNING CHRONICLE OFFICE.

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OFFICE OF THE QUEBEC & RICHMOND RAILWAY COMPANY.

QUEBEC, August 15th, 1851.

To the President and Directors of the Quebec and Richmond Railroad Company.

GENTLEMEN:

Having in accordance with your instructions, completed the survey of a continuous line for your road from Richmond to the city of Quebec, I have the honor to submit the following report thereon:—

The survey was commenced at a point on the St. Lawrence and Atlantic Railroad in the village of Richmond, on the 19th of February last, and was continued through the inclement period of the year, with little or no interruption. During a portion of the spring, it was deemed advisable to suspend field operations, the country being flowed with water to a considerable extent, but this time was usefully employed in the office, in preparing plans, profiles, and estimates of cost of that portion of the line then surveyed. After a few weeks interruption, the field work was again resumed, but long continued rains delayed the completion of the work, till the 12th of July.

The section of country traversed by the line, is of a gently undulating character, and is drained by some of the smaller tributaries of the St. Francis river, running in a westerly direction, and the Nicolet, Bécancour, and Duchesne rivers, running north-westerly into the St. Lawrence.

The line passes through the townships of Shipton, Tingwick, Warwick, Arthabaska, Stanfold, Somerset, and Nelson, and through the Seigniories of St. Croix, St. Giles, St. Antoine, St. Nicholas, and Lauzon.

The elevation of the diverging point of the line on the St. Lawrence and Atlantic Railroad, is about 375 feet above tide, and the elevation of the country passed over by the line on the southerly side of the St. Lawrence, varies from 200 to 540 feet.

The grounds in the immediate vicinity of the river, are precipitous and broken, and the streams entering it in the vicinity of Quebec, from the south, pass through deep narrow gorges, having a rapid descent and a winding, irregular course.

The principal difficulty encountered on the route, is found in approaching the St. Lawrence river, and although other portions of the line follow a course transversely to the direction of the principal streams, yet the grades and cost of construction may be regarded as favorable.

In leaving the valley of the St. Francis and running in the general direction of Quebec, it becomes necessary to cross the dividing grounds between the waters of the above mentioned stream and those of the Nicolet. This is accomplished by following up a small stream which enters the St. Francis at Richmond, to its source and thence striking across to the head of Beaver brook, which is a tributary to the Nicolet. The distance from Richmond to this summit is 4 3-5 miles and it is elevated 122 feet above the grade of the road at the former place. In overcoming this elevation, a grade of 50 feet per mile, for about $1\frac{3}{4}$ miles, is required, and on the remainder of the distance, the grades vary from a level to 30 feet per mile.

In crossing other undulations of the country, no gradients are required exceeding 37 feet per mile, with one exception, which is 42 feet. This may probably be reduced to the same maximum without increased expense.

The crossings of the streams are usually favorable, and the cuttings and fillings, with the exception of those on the portion of the line descending to the St. Lawrence are light.

The present survey may be regarded as only an approximate location, and I doubt not that with the aid of the information now acquired, improvements may be made on some portions of the line, which will give more favorable results. This may readily be done, after the commencement of the work shall have been determined upon.

In the townships of Somerset and Stanfold there have been three lines surveyed, two of which diverge near the South line of Stanfold, and unite one mile North of the village of Somerset. One line bears Northerly, passing through the village of Stanfold and crosses the river Blanche near the village of Somerset. This line may be so modified as to pass through the latter place without any material deviation from a direct course or additional expense.

The other line occupies a more Southerly position avoids the village of Stanfold and passes through Somerset. This line although shorter than the North line by 3500 feet, unavoidably encounters heavier grades and more expensive work. There is a gradient on this line, of 70 feet per mile for $1\frac{3}{4}$ miles. This is required in crossing an elevated ridge on the Southerly side of the River Blanche. A branch line from this was surveyed, diverging on the Southerly side of this ridge and pursuing a still more Southerly route crosses the valley of the River Blanche at a point about one mile above Somerset.

Although this modification of the South line permits more favorrble grades yet the expense and the distance is considerably increased and it avoids the village of Somerset, which is a point of some importance.

The North line, by a slight modification may pass through both the villages of Stanfold and Somerset. It is the most favoraable as regards grades and cost, and its position being such as to draw

to the road the largest amount of trade, its adoption is respectfully recommended.

The instructions uuder which the survey was made, confined our examinations for discending to the St. Lawrence River, to the Parish of St. Nicholas, and to Point Platon, both of which places contemplate the use of a ferry and the extension of the road to the city of Quebec, on the Northerly side of the river. The former crossing gives a distance of road to be built on that side of the river, of $8\frac{3}{4}$ miles, and the latter about 35 miles.

On a reconnoissance of the ground in the immediate vicinity of Point Platon, and Portneuf on the opposite side of the river, it appeared of an unfavorable character which together with the great additional length of road to be built on this route, seemed to render it unnecessary that a detailed survey of the whole should be made. An instrumental examination was made to ascertain the height of the table land at Point Platon, and practicability of distributing the ascent over ground admitting of the use of locomotive power and reasonable expense of construction. Commencing a grade of 70 feet per mile at the pier, the principal elevation would be overcome in a distance of about 2 miles, thence a gradient of less inclination would carry the line to the top of the table.

In making a terminus on the South side of the river it would be necessary to have at least half a mile of level ground for depot and other purposes, but as the water increases in depth and rapidity at that place, it would probably be necessary to adopt a gradient of 80 to 90 féet per mile commencing a short distance from the river, thus giving an opportunity for a short distance of level road. The length of this grade would be $1\frac{3}{4}$ miles and the road-bed would necessarily be formed in the nearly perpendicular cliff and steep banks of the river.

The work would be very expensivé and the line circuitous. To develope the line by extending it further down the river, with a view to lessen the inclination, would place the road on unfavorable

and more elevated ground in leaving the river in the direction of the Becancour.

At Portneuf, on the opposite side of the river, a long and expensive pier would have to be constructed in consequence of the great distance of shoal water. There would however, be less difficulty in surmounting the elevated grounds in the vicinity of the river, than at Platon, from the facilities afforded by the valley of a stream of considerable size, which here enters the St. Lawrence.

In addition to the difficulties above referred to, is the greatly increased distance required for this route above all others. From the best information that can be obtained, short of a survey of the whole route, it is believed that the distance will exceed that of the St. Nicholas route, about 20 miles.

In view, therefore, of these facts, I would respectfully recommend that this route be abandoned.

Extensive surveys have been made in the Parish of St. Nicholas, in the vicinity of the St. Lawrence, with a view to determine the most feasible plan of overcoming the difficulties of effecting a descent from the elevated table grounds to the river.

There are two small streams which enter the St. Lawrence within this parish, and are known as St. Nicholas river and Frechette's mill stream. The latter reaches the St. Lawrence opposite Cap Rouge and the former at a point known as Ross' mills, which is about two miles above. The depressions in the high grounds formed by the entrance of these streams, afford the only means of reaching the level of the St. Lawrence in the Parish of St. Nicholas without a very great developement of the line and an unreasonable expenditure for grading. Availing ourselves of the greater advantages afforded by these valleys, we nevertheless find that the obstacles are still of a somewhat formidable character.

The position of Frechette's mill stream is such that it cannot be reached without encountering an amount of curvature at two points,

equal to 180 degrees each, or resorting to the use of switches or culminating points in place of curves, either of which would be highly objectionable.

The rapid descent of the stream, the greater portion of the fall being confined to a distance of 1,000 feet, renders a long and expensive cutting necessary, the grade of the road being far below the bed of the stream, and in approaching the bank of the river, a heavy embankment is also required. The distance by this route will exceed that of the St. Nicholas river by $2\frac{1}{4}$ miles, yet this increased distance does not to any extent, favor a more equal distribution of the descent. These difficulties are such as to render the route impracticable, having a proper regard to reasonable expenditure for construction and the usefulness of the road when completed.

The valley of St. Nicholas river, facilitates in some degree the approach to the St. Lawrence, on account of its general direction being favorable, yet it is exceedingly irregular in its course, and the banks are high and broken. The upper portion of the valley has not a very rapid descent, but on arriving at the St. Lawrence, this stream descends 135 feet in a distance of 900 feet. The character of the valley and the stream approaching this point, does not permit its bed to be lowered so as to be of much avail in reducing the gradient, therefore there is no way of accomplishing the descent except by following the precipitous and rocky banks of the St. Lawrence, descending to the level of that river at a point nearly opposite Cap Rouge.

This is found to be difficult on account of the irregularity of the grounds, and heavy work is unavoidably encountered.

A line has been traced down the St. Nicholas valley, and along the banks of the St. Lawrence, having a maximum gradient of 55 feet per mile for $5\frac{1}{3}$ miles, terminating nearly opposite Cap Rouge. This gradient suits the upper portion of the valley very well, but for the last two miles, it gives excessively heavy work, requiring a greater expenditure than would be advisable to incur. A gradient

of from 70 to 80 feet per mile, for two miles, would avoid considerable curvature and reduce the cost within reasonable bounds, and is regarded, under all the circumstances, as preferable.

This gradient, being at the terminus on the river, may be considered as less objectionable; for additional power is always at hand to assist in overcoming it, should occasion require. But such an occasion is not likely to occur, for it is believed that the tonnage of trains at this place will seldom exceed the power of the engines.

With this gradient, there will be about $1\frac{1}{2}$ miles of level road in leaving the river, which would be an advantage to trains ascending it, and with the greatest probable weight of trains, it would be attended with little or no objection except perhaps a slight diminution of speed.

I would not wish to be understood as advocating grades of this class, except in cases where a great saving in cost may be made, and when from the nature of the business to be done, it will result in no material inconvenience or increased expence in operating the road.

Gradients of this class, and even much greater are adopted on important trunk lines in the United States, and although in most cases unavoidable, these instances show that such roads nevertheless have the capacity to do an immense business and prove profitable investments.

It may be proper to state in connection with this subject, that further and more minute surveys, which would be required in making a final location of so important a portion of the work, may show that these difficulties can in some measure be avoided or so modified as to admit a reduction of the inclination of this gradient without excessive cost.

The line, as before stated, was carried across the river to Cap Rouge, and thence to the City of Quebec. The distance from the end of the proposed pier on the southerly side, to that on the opposite side at Cap Rouge is $1\frac{1}{3}$ miles.

Deep water is reached in a short distance on the southerly side of the river, but at Cap Rouge the distance is greater, requiring a pier of about 1500 feet in length to reach the required depth of water.

The ground in leaving the river at Cap Rouge, and for the whole distance between that place & Quebec is of the most favorable character for the construction of a road. The maximum grade need not exceed 20 feet per mile, except for a short distance within the city, where the grade of the road should conform to that of the streets. The greater portion of the road from Cap Rouge to Quebec, will be level or nearly so. The distance is a trifle less than nine miles, and on the greater portion of it, the cost of grading unusually cheap.

The total distance from Richmond to Quebec, as now surveyed, is 101½ miles. The total distance surveyed, including the survey of subordinate routes and side lines amounts to an aggregate of 154¾ miles.

ESTIMATES OF COST.

The estimates of quantities are based upon the requisite width of road-bed for a single tract, with the usual slopes and a proper allowance for side tracts.

The masonry for the more important structures is supposed to be hammer dressed, with quary faces, and the culverts, small bridges, passes, &c. to be of substantial rubble masonry.

Stone of a suitable character for this masonry is found on large portion of the line, but at points where suitable material is not found in the vicinity, it is proposed to adopt wooden structures for a few years when permanent work may readily be substituted, the materials being transported on the road to points required. The track is to be formed of such timber as is found along the line, with a rail weighing 100 tons to the mile. The wharves are supposed to be constructed of timber, with stone filling, and of the

requisite width for three tracts, and for the reception and transfer of passengers and the various kinds of freight.

The buildings are supposed to be principally of wood, and of such dimensions as to accommodate the business of the road, without reference to any great increase from other railway connections. In the erection of the buildings required at the junction with the St. Lawrence and Atlantic Railroad, the two corporations will doubtless bear the expense jointly. The amount of machinery embraced in the estimate, is sufficient for the business for a few years, additions to which may be made from time to time as the increase of business may require. It is proper to state that a considerably large equipment is necessary to operate the road in consequence of its being divided into two distinct parts.

The land for the roadway and stations from Richmond to the Becancour river, will be obtained free of charge or at a very low rate. From the Becancour River to the St. Lawrence, the land passed over by the line, is in a high state of cultivation and there being a much greater number of proprietors, the cost will consequently be considerably greater.

From the same and other causes, the lands from Cap Rouge to Quebec, will cost much more than on any other portion of the line.

The cost of land is an exceedingly uncertain item of expenditure, depending on judicious management of the agent to whom this business is entrusted, the intelligence and liberality of the proprietors and the character of the country.

The amount allowed in the estimate for these items are more than could be allowed by a just and equitable appraisement.

ESTIMATE.

ITEMS.	Quantities	Prices.	Amount.	Aggregate.
Cleaning and Grubbing...			£14,000	£14,000
Earth Work.	Cubic yds			
Excavation Earth, including haul.....	1854000	£ s. d. 1 3	115,875	
Do do do.....	380,000	1 6	28,500	
Do Solid Rock.....	190,000	4 3	40,375	
Do Loose do	54,000	2 0	5,400	
Do in Pit.....	65,000	1 6	4,875	195,025
Masonry.				
Bridges Abutments and Piers.....	14,152	1 5 0	17,690	
Culverts.....	21,600	12 6	13,500	
Protection Wall.....	5,600	7 6	2,100	
Bridge and Culvert foundations.....	9,500		9,500	42,790
Bridge Superstructure.	Linear ft			
Truss Bridging.....	1,700	5 0 0	8,500	
Do do	550	4 0 0	2,200	10,700
Track.	Miles.			
Main Track.....	100½	1550 0 0	155,775	
Side track and fixtures...			10,750	166,525
Machinery.	Number.			
Locomotive Engines.....	7	2000 0 0	14,000	
Passsenger Cars.....	9	625 0 0	5,625	
Baggage and Mail Cars..	3	250 0 0	750	
Box Freight Cars.....	13	200 0 0	2,600	
Platform Cars.....	18	175 0 0	3,150	
Earth Cars.....	25	80 0 0	2,000	
Hand Cars.....	13	20 0 0	260	
Snow Ploughs.....	3	225 0 0	675	29,060
Buildings and Fixtures...			15,750	15,750
Road and Farm Crossings.			12,500	12,500
Land and Fencing.....			16,000	16,000
Wharves.....			15,500	15,500
Total cost.....				£517,850
Average cost per mile..£5,152.				

The preceding estimate includes the cost of the whole road, with equipment for the commencement of business. It is proper to state that the road on the southerly side of the St. Lawrence river is distinct from that on the northerly side, it therefore follows that each must be furnished with machinery, and operated separately. The road having four termini, requires also an additional number of station buildings, turning tables, fixtures, &c., and an additional expenditure for wharves.

The expenditure for machinery and buildings which is required for the short piece of road on the northerly side of the St. Lawrence, would probably be equal to the cost of the same items for the one third of the road on the opposite side of the river, the whole being operated in connection. The cost also of operating a short road it is well known is much greater in proportion to its length than for a long one.

The total cost of the whole road as per estimate is £517,850, or an average cost of £5,152 per mile. The cost of the road from Richmond to the St. Lawrence river is £455,106, and the distance 91 1-3 miles, giving an average cost on this part of the line of £4,983 per mile.

The total cost of the road from Cap Rouge to Quebec is £62,744, or an average of £6,970 per mile.

In view of the importance of your road, which is to form a part of the great trunk line through the Provinces, and the necessity of placing it in such a position as will facilitate a connection with the Halifax line; I say, in view of these facts, the question of routes approaching the southerly side of the St. Lawrence, is one which should re ceive the most mature and serious consider ation.

I can on this occasion only present the facts so far as developed by the surveys above described, and until further surveys are made, I am unprepared to institute a comparison of the merits of the various proposed routes, or to recommend any route for that part of the road between the Becancour and the St. Lawrence for your adoption.

Two points I conceive must be quite clear to every mind, which are these :—that your road must have a direct and favorable connection with the Halifax line, should that road be built, and that the terminus of your road on the St. Lawrence should not be fixed without reference to this connection.

There is one plan of forming this connection which so far as I am informed has not been suggested. It is to descend to the St. Lawrence through the St. Nicholas valley, and thence follow the bank of the river to some point opposite Quebec.

Although I am unable to judge of the merits of this route with any degree of certainty, as contrasted with others, without an instrumental examination, yet it appears to present facilities for descending the St. Lawrence, with gradients quite as favorable as those on other routes.

The cost of construction on this route it is believed will not be considered extravagant in view of the importance of the connection, and all things considered, may compare favorably with other routes. If it should be deemed advisable to make an examination of this route, very few changes would be required in the general features of the present survey of the St. Nicholas route, to extend the line for this connection.

The question of terminus on the southerly side of the St. Lawrence involves the necessity of surveying several routes in the most careful manner.

The line from Richmond to the Becancour, a distance of 62 miles is common to all these routes, and the definite location of this part of the road may be made and the work placed under contract during the progress of the surveys of the various routes to the St. Lawrence.

That part of the road passes through a highly favorable country for the cheap construction of the road, and but little time is required to prepare the line for the commencement of the work.

The prospective business of your road is a subject which at the present time I am unprepared to present with much detail, not being in possession of the requisite statistical information. I may briefly remark, however, that the country through which the line passes, is cultivated to a considerable extent, and possesses great agricultural capabilities.

Water power is abundant along the line, and at several points, villages have grown up which contain an active and enterprising population.

The villages of Danville, Stanford and Somerset are places of some importance, where the trade of the surrounding country is concentrated, and will furnish a considerable amount of business for your road.

The townships south and east of the line are rapidly being settled by a hardy and industrious population, and the country generally is advancing in improvements and in the amount of its products.

At the falls of the Becancour in the township of Inverness, there is a valuable water power, and from its favorable position it will doubtless become a flourishing place. The water power is already improved to some extent, and it being situated at the foot of a chain of lakes, which furnish the means of transporting the timber of the adjacent country to their mills, it adds much to the business capabilities of the place. With the means of reaching market which would be furnished by the construction of your road, the amount of lumber manufactured here, would be greatly increased. It is not practicable to carry the road to a point nearer this place than about six miles, without too great a deviation of the line from a direct course, and a large additional expenditure.

With a view to the accommodation of the business of the place, and that of the flourishing townships in this direction, it has been suggested that a branch from the main road should be extended up the Becancour river. This is practicable, and is a question which in the construction of your road, will doubtless receive due consideration.

The city of Quebec is the principal port on the St. Lawrence for sea going vessels and being connected with the "far west" by the most magnificent line of inland navigation in the world, enjoys great commercial advantages and has an extensive trade in lumber and breadstuffs and is largely engaged in shipbuilding.

There were in 1850, 1064 vessels, having an aggregate measurement of 475,440 tons, loaded with timber at this port. The total measurement of vessels built in 1850, was 30,387 tons.

The value of exports from the port of Quebec in 1850 were £1,297,423, and of imports £686,441. The assessed valuation of real estate for the city of Quebec is £2,500,000.

The establishment of the seat of Government at Quebec, will add much to its growth and prosperity and largely increase the travel in this direction.

The population of the city and county of Quebec, according to the census of 1848, is 49,000. The population by the same census of the several counties contiguous to the line of the road on the Southerly side of the St. Lawrence, was 89,336 or an aggregate of 138,336.

At the present time this population is probably not less than 150,000. There has been a great increase in the population of the townships, within a few years from emigration.

This population being on or in the immediate vicinity of the road, is directly interested in its construction and will make up the local business of the road. It is however important to take a more ex tended view of the sources of business which may justly be claimed for your line.

The connection which your road is to form with those proposed or in progress, gives it an important position.

It forms part of the grand trunk line now in contemplation, which is to extend from Halifax through all the Provinces, to the River St. Clair, a distance of 1388 miles, While it constitutes a part of

this great line, it furnishes a connection with the St. Lawrence and Atlantic road, a direct railway communcation between the cities of Montreal and Quebec, which exceeds but a trifle the distance by the river, and will give a saving of time during the season of navigation, of from 3 to 4 hours, and for half the year a saving of one day to each passenger. The intercourse between these important cities, which contain an aggregate population of 90,000, is very great, but when they shall be connected by a railway the travel will be vastly increased. An immense number of pleasure tourists annually visit the St. Lawrence, and the greater portion are drawn to Quebec, from its historical associations and the unequalled attractions of the surrounding country. The greater portion of this travel will be attracted to the road, or at least will pass over it in one direction.

Your road also perfects a direct railway communcation from Quebec to Portland, Boston and New York, and by connecting railways to almost every part of the United States.

Travellers descending the St. Lawrence, will thus be furnished with a most expeditious and attractive route to the seaboard, with an opportunity of visiting the White Mountains on the way, or return to Montreal by railway and thence visit Lake George and the Springs, in either case passing over the whole of your road. Your road also connects Quebec with the eastern portion of Maine, through the Portland & Montreal road and other railways of Maine, and eventually with the lower Provinces through the proposed European & North American Railway.

It occupies a central position in the great trunk line through the Provinces, and the larger portion of the European or other travel which will be drawn from that route, from either direction, will pass over it.

Having a winter communication with Atlantic Ports, merchants will not necessarily be obliged to purchase six months stock of goods in the fall, but importations may be made monthly if desirable,

and thus take advantage of the market and at the same time secure seasonable goods.

With this general view of the connections and business of your road, I may remark that the value of its stock, will much depend upon its judicious location and management. If this is secured and its connections with the trunk lines of the Provinces and the United States perfected, there is a reasonable degree of assurance that it will be a remunerative investment.

This however, is but a limited view of the subject. The great benefits which are to be derived from its construction by the whole of the townships east of the St. Francis River, in opening a cheap and expeditious means of reaching a market, in the settlement of vacant lands—and in the vastly increased value of almost every description of property both in the country and the city are considerations far outweighing all others.

Experience has shown in nearly all similar undertakings, that the increased value of property consequent upon their construction, and the benefits accruing from a vastly increased amount of business in cities and towns on and adjacent thereto, have been greater than the cost of the works themselves. The secluded district of country through which your road passes, the absence of cheap communications to reach a market, and the peculiar position of Quebec, are substantial reasons for supposing that similar results will follow the construction of your road.

In conclusion I have to acknowledge my obligations to R. T. Bailey, Esquire, who was appointed to the chief charge of the work, and to his assistants, for the energetic and skilful manner in which so extensive a survey was accomplished at the most inclement period of the year.

I have the honor to be,

Gentlemen,

Your most obed't serv't,

A. C. MORTON.

Civil Engineer.